

Project title:	Protected Lettuce – An investigation into the use of seed treatments for the control of pests & disease
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Project leader:	Dr. Pat Croft and Ms Cathryn Lambourne STC Research Foundation
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Key staff:	Dr Pat Croft Ms Cathryn Lambourne Dr Luke Tilley
Location of project:	Stockbridge Technology Centre
Industry Representative:	Mr Geoffrey Smith, Mapleton Growers Ltd.
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The results and conclusions in this report are based on a desk study conducted over a six month period. The raw data that constitute the results of this study were obtained from Defra and the HOMOLOGA database. The responsibility for the accuracy and reliability of the database lies with Defra. This report represents a summary of results from the HOMOLOGA data and care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

Dr. Pat Croft
Project Leader
STCRF

Signature Date

Ms Cathryn Lambourne
Project Leader
STCRF

Signature Date

Report authorised by:

Dr. Martin McPherson
Science Director
STCRF

Signature Date

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GROWER SUMMARY

Headline

Twenty-one fungicide and three insecticide active ingredients are approved for use as seed treatments in various parts of the world. However, only one insecticide (imidacloprid) and one fungicide (thiram) are approved for use in the UK.

Background

Minimisation of pesticide applications in lettuce crops is an ongoing requirement. Seed treatments, other than imidacloprid (aphid control) and thiram (to control damping-off diseases) are not widely available on lettuce in the UK. Novel methods for pesticide applications to seed during propagation have been developed, but have not been evaluated in the UK. This desk study evaluates the current market for pesticides as seed treatments in protected lettuce. This information can then be used to inform grower decisions about future pest and disease control options.

Summary

This desk study seeks to inform growers of the seed treatments that are currently approved for use on protected lettuce in other countries and the UK against pests and diseases. Two seed treatments are currently available for use on lettuce in the UK. The lack of pesticides for use as seed treatments in the UK compared to other countries leaves scope for investigation of new active ingredients to be included as control options in the future. The HOMOLOGA database of global pesticide approvals (DEFRA) contains current information about active ingredients across the world. Using this database, the active ingredients were separated into insecticides and fungicides and information about their country of approval, supplier, formulation and named products was collected and listed.

Insecticides

- Three insecticides (imidacloprid, permethrin and thiamethoxam) are in use as seed treatments.
- Only imidacloprid currently has approval in the UK.
- Thiamethoxam is approved for use against a number of named aphid species in both the USA and the Netherlands (*Macrosiphum euphorbiae*, *Myzus persicae*, *Nasonovia*

ribisnigris and *Pemphigus bursarius*) (HDC project PC290 showed that *Aulacorthum solani* can also be effectively controlled using neonicotinoids as seed treatments).

- Generally, only a small number of products have approval within and outside the UK.
- The agrochemical companies contacted as part of this study reported that they were not planning to seek approval for more insecticide seed treatments in the UK, apart from one company (Certis Europe) that have a new seed treatment under development in France.
- Future trials to investigate the efficacy of thiamethoxam and permethrin would be useful to increase aphid control options in lettuce.

Fungicides

- A much wider range of fungicides is in use as seed treatments compared to insecticides.
- Twenty-one individual active ingredients were listed as seed treatment fungicides and five treatments included two different active ingredients.
- Only thiram currently has approval in the UK.
- Generally, a large number of products and different formulations have approval across the countries included.
- The agrochemical companies (Dow Agrosciences, Bayer Cropscience, Syngenta, Certis Europe and Makhteshim Agan) contacted as part of this study reported that they were not planning to seek approval for more fungicide seed treatments in the UK.
- Future trials should focus on investigating the disease control efficacy of a selection of the products listed from the database.

Biological Control and Physical Methods

- A previous EU funded project (STOVE) (QLK5-2002-02239) investigated seed treatments for organic vegetable production; amongst other crops and diseases, it looked at methods to control damping-off diseases in protected lambs' lettuce.

- The results of STOVE showed that the combination of biological and physical methods together reduced disease from 10% to 0% of the crop. However, germination success was very variable in the seeds that underwent combined biological and physical treatment.
- Although the three physical methods part of STOVE were hot water, hot humid air and electron treatment, the biological treatments investigated were not named in each case.
- Two biological seed treatments that may be of interest to lettuce growers that arose from searches and discussions with suppliers are:
 - Poncho / VOTiVO (Bayer CropScience) – a combination treatment of two biological fungicide seed treatments for damping-off diseases
 - DISCO Care (SeedQuest Solutions) – beneficial microorganism coating for seeds to target *Pythium* spp. among other pathogens.

Insecticides: this study shows that growers of protected lettuce worldwide are forced to rely on three seed treatments; imidacloprid, permethrin and thiamethoxam. A previous HDC report, PC 290, confirms that neonicotinoid seed treatments can provide good aphid control, and it is suggested that future insecticide trials should focus on the efficacy of thiamethoxam (neonicotinoid) and permethrin (pyrethroid) for aphid control.

Fungicides: There are 21 active ingredients and 5 combined treatments worldwide, supplied various formulations by a large number of companies. It is suggested that future work on fungicide seed treatments should be concentrated on the fungicides highlighted in this report.

Financial Benefits

The financial value of this study is difficult to appraise. However, this work will help to inform UK growers about the international usage of pesticides as lettuce seed treatments and may bring benefits through reductions in amounts of active compounds used and reduced labour for spray applications.

Action Points

The aim of this desk study was to carry out a search for information and liaise with contacts in agrochemical and biocontrol companies to produce a definitive list of all seed treatments available for protected lettuce to control pest and disease.

- Growers now have access to information about seed treatments approved in other countries. The information collected for this study can be used to design future trials to investigate the efficacy of these products. There are two insecticides (permethrin and thiamethoxam) and many fungicides listed that may be useful to UK growers.

References

HOMOLOGA Database of pesticide approvals (FERA, Defra – URL:
<http://www.fera.defra.gov.uk/foodDrink/decisionSupportTools/homologa/index.cfm>)

PC290 – Protected lettuce: development of robust IPM strategies for the control of aphids.
Horticultural Development Company

CRD Approval Guidelines for applicants
<http://www.pesticides.gov.uk/approvals.asp?id=3019>

Europa – Gateway to the European Union (Plant protection)
http://ec.europa.eu/food/plant/protection/pesticides/index_en.htm

IR4 Project - <http://ir4.rutgers.edu/>

EU funded project (STOVE) (QLK5-2002-02239)
http://www.coreorganic.org/library/EU_folder/stove.pdf

Appendices

Glossary

The following formulation codes apply to Appendices 1 and 2

DP	Dustable Powder	SC	Suspension concentrate
EC	Emulsifiable concentrate	SG	Water soluble granules
FS	Flowable concentrate for seed treatment	SL	Soluble concentrate
LI	Liquid, unspecified	WB	Water soluble bags
OF	Oil miscible flowable	WG	Water dispersible granules
RTU	Ready-to-use mix	WP	Wettable powder

Appendix 1: Insecticides approved for use as seed treatments on protected lettuce (product names in **bold** are approved in the UK).

Active Ingredient	Country of approval	Company/Supplier	Formulation	Product names
Imidacloprid	Belgium; Netherlands; UK	Bayer CropScience; Nufarm	OF; WS	Gaicho ; Gaicho 70 WS; Gaicho Tuinbouw; Nuprid 4.6F Pro Insecticide
Permethrin	USA	FMC; Gharda	EC WB; WP	Pounce 25 STD Seed Treatment Insecticide; Pounce 3.2 ST Seed Treatment Insecticide; Reality 25 Insecticide
Thiamethoxam	Netherlands; USA	Syngenta	WS; WP	Cruiser 70 WS Insecticide

Appendix 2: Fungicides approved for use as seed treatments on protected lettuce (product names in **bold** are approved in the UK)

Active Ingredient	Country of approval	Target pathogen	Company/Supplier	Formulations	Product name
Azoxystrobin	Canada; USA	<i>Pythium</i> spp; <i>Phomopsis</i> spp	Loveland Industries; Syngenta	SL	Dynasty; Dynasty 100FS Fungicide; Dyna-shield Azoxystrobin Fungicide
Benomyl	Japan	<i>Fusarium</i> spp	Sumitomo	WP	Benlate Suiwazai
Benomyl & thiram *	Japan	<i>Fusarium</i> spp	Sumitomo	WP	Benlate T Suiwazai 20
Captan	Chile; Hungary; Italy; Japan	<i>Pythium</i> spp; <i>Rhizoctonia</i> spp; other pathogens	Arista; Arysta Lifescience; Chemia; Chimiberg; Diachem; Hokko; Isagro; Magan Agro; Makhteshim Agan; Nufarm; Siapa; Sipcam; Terranalisi	WP; PW; FS; WG; SC; LP	Benlate Suiwazai 80; Bollanet; Cap 80 WDG; Captan 50 WP; Captan 83 WP; Captane 80 DF; Captano 80 WG; Clomitane; Hokko Orthocide Suiwazai 80; Make Up 480 SC; Make Up 80 WDG; Make Up SC; Merpan 480 SC; Merpan 80 WDG; Orthocid 50 WP; Santhane 80 WDG; Tetracap 80 DG
Chitosan**	USA	unspecified	Agrihouse	SL	Yea! Field Enhancing Agent
Copper Chloride	Japan	<i>Pseudomonas syringae</i> ; <i>Erminia</i> spp; seed-borne pathogens	Hokko	WP	Deutsche Bordeaux A for vegetable and seed
Etridiazole	Italy	other pathogens	Agrimport; Castaldo; Uniroyal-Crompton (Chemtura)	EC; WP	Terrazole 25% EC; Terrazole 35% WP
Fludioxonil	USA	unspecified	Syngenta; Loveland Industries	SL; EC	Dyna-shield Fludioxonil Fungicide; Maxim 4FS
Fludioxonil and metalaxyl-methyl *	USA	unspecified	Syngenta	EC	Maxim XL Fungicide
Flutolanil	Japan	<i>Rhizoctonia</i> spp	Nihon Nohyaku ; Nissan	WP	Moncut Suiwazai; Nissan Moncut Suiwazai
Fosetyl-Al and propamocarb-HCl *	France	downy mildew; seed-borne pathogens	Philagro	SL	Previcur Energy
Ipconazole	USA	unspecified	Bayer Cropscience; Uniroyal-Crompton (Chemtura)	RTU; OF	Vortex; Rancona 2.8 FS
Ipconazole and metalaxyl *	USA	unspecified	Bayer Cropscience	RTU	Vortex 2000
Iprodione	France; Japan	<i>Rhizoctonia</i> spp; seed-borne pathogens; <i>Alternaria</i> spp	Africhem; Agrotech; BASF; Bayer Cropscience Endres; Merath; Kyoyu Agri;	WP; SC	Agrotech Iprodione; Iprodial 50; Ipromex 50% WP; Kyoyu Rovral Suiwazai; Larvor+; Rovral; Rovral Aqua Flo; Rovral Suiwazai; Sanodione
Mancozeb	France; Italy	downy mildew; other pathogens	Agrimport; Agropiave; Arysta Lifescience; Atochem-Cerexagri; B.E. Di B.R.; Bayer Cropscience; BHS; Certis ; Cheminova; De Sangosse; Demetra; Dow Agrosciences; Dupont ; Geofin; Gowan; Indofil; Isagro; Manica; Philagro; PHM International; Phyteurop; Quimica Masso; Scam; Siapa; Simar; Sipcam; Sivam; Syngenta; Terranalisi; Tradi Agri	WP; WG; AS; SC	Acarie M; Addax; Addax DG; Agrizeb 75 DG; Agrizeb 80; Agrizeb DG; Aliado 75 DF; Asar 80; Asar WDG; Aspor WDG; Aspor WG; Azul MZ 75 WG; Azul MZ 80 WP; Barky; Caiman Jardin; Caiman WP; Crittox GD 75; Crittox WG; Dequiman MZ; Dequiman MZ Plus; Dequizebe Bleu; Bithane DG Neotec; Dithane M 45; Dithane M-45 LF; Dithane M-45 LF; Dithane M-45; Dithane Neotec; Dithane Neotec DG; Dithane SH; Filzeb; Fore WP; Fungi MZ DF; Geozeb WG; Kavea; Kavea DG; Korzebe 80 PM; Leadazebe; Leadazebe 80; M 70 DF; Manatane 80; Mancofor 800; Manconyl 80; Manconyl DG; Mancoplus 80 PM; Mancosim 75 DF; Mancospor; Mancotec; Mancozeb Manica 75 WG; Mancozeb Manica 80 PB; Manfil 75 WG; Manfil 80 WP; Manflo; Manthene WDG; Mantir 75 DG; Mantir DG; Mazebe; Micene 75 SG; Milcozebe; Penncozeb; Penncozeb DG; Pennfluid; Pennzebe; Sandozebe; Sandozebe DG; Sproutnik 80; Trimanec DG; Penncozeb DG; Trimanoc 80 WP; Trimanec Bleu; Triziman M; Trimanoc Xpert; Vondozebe DG; ZM 75 DG

Active Ingredient	Country of approval	Target pathogen	Company/Supplier	Formulations	Product name
Maneb	France	downy mildew; Uredinales	Atochem-Cerexagri	WP	Dequiman Plus; Dequinebe; Dithane M 22 A; Pennebe; Stabineb 80; Trimangol PM
Maneb and thiophanate-methyl *	Italy	other pathogens	Sipcam	WP	Frumidor
Mepronil Metalaxyl	Japan Canada; Chile; Japan; USA	<i>Rhizoctonia</i> spp <i>Bremia lactucae</i> ; <i>Peronospora destructor</i> ; <i>Pythium</i> spp	Kumiai Agricola Nacional SACI; Albaugh Chemical; Bayer Cropscience; LG Life Sciences; Loveland Industries; Nufarm; Syngenta; Uniroyal-Crompton (Chemtura); Wilbur Ellis	WP DP; EC; OF; RTU; SL; WB; WP	Basitac Suiwazai Apron Flowable; Apron TL; Apron XL; Apron XL LS; Apron XL WS; LS Fungicide Belmont 2.7 FS; Dyna-shield Mefenoxam Fungicide; Dyna-shield Metalaxyl Fungicide; Gustafson; Allegiance 50WP; Gustafson Allegiance-FL Seed Treatment Fungicide; Metalaxil 25 DP; Metalaxyl 28.35% FL S; Metastar ST; Ridomil Suiwazai; Sebring 318 FS Fungicide; Sebring 480 FS Fungicide
Pencycuron Potassium phosphite Propamocarb HCl	Italy USA France; Italy	other diseases unspecified <i>Phytophthora</i> spp; <i>Pythium</i> spp; other pathogens	Chemia; Scam Liquid Fertiliser; Winfield Solutions Agrimport; Agriphar; Agrisystem; Agrochima; Agrowin Biosciences; Bayer Cropscience; Chemia; Chimiberg; CIFO; Gowan; Kollant; KS Agrochemicals; Makhteshim Agan; Nufarm; Philagro; Prochimag; Mandrioli Guiseppe; Scam; Scotts	SC EC EC; LI; SC; SL	Litanie FL; Pencur Agri-fos Systemic Fungicide; Phosphorus Acid Systemic Fungicide Auriga; Pam; Pikar; Pit Stop; Previcur; Previcur N; Previter; Promag; Proplant; Proxan SL
Pyraclostrobin Thiophanate-methyl	USA France; USA	unspecified seed-borne pathogens	BASF Certis USA; Nisso; Nippon Soda	EC; WG OF; SC; WG	Bas 500 ST Seed Treatment Fungicide; Stamina Fungicide Seed Treatment Topsin; Topsin 4.5 FL; Topsin 4.5 FL
Thiophanate-methyl and thiram *	Japan	<i>Rhizoctonia</i> spp	Nippon Soda	WP	Homai Suiwazai
Thiram	Canada; France; Great Britain; Hungary; Italy; Japan; Netherlands; USA	<i>Phytophthora</i> spp; <i>Pythium</i> spp; <i>Phoma</i> spp; Ustilginales; <i>Fusarium</i> spp; other pathogens; <i>Rhizoctonia</i> spp	Agri-Chem; Atochem Cerexagri; Bayer Cropscience; Castaldo; Chemtura; Hermoo; Hokkai Sankyo; Hokko; Isagro; Siapa; Sivam; Taminco; Terranalis; Uniroyal-Crompton (Chemtura)	-	AgriChem Flowable Thiram ; Gustafson 42-S Thiram Fungicide; Gustafson Thiram 50WP Dyed; Pomarsol; Pomarsol 50 WG; Pomarsol 80 WG; Pomarsol; Pomarsol; Ultradispersible; Royalflo; Sankyo Thiuram 80; Silfur GD 50; Silfur GD 51; Silfur WG; Spotrete F Fungicide; Thianosan 80 WG; Thiram 42-S; Thiram 75WP Fruit, Vegetable and Turf Fungicide; Thiram 75WP Wettable Powder Fungicide; Thiuramin Suiwazai; TMTD 40 L; TMTD 50 SC
Tolclofos-methyl	Italy	other pathogens	BASF; Scam; Scotts Sumitomo	WP	Grolen; Patchveiss; Rizolex Gold

* Seed treatment containing two active ingredients.

** Not strictly a fungicide but has been shown to have fungicidal activity